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spotted with brownish black. Tail dark on the terminal half, the tip for only about an inch, white. Graduation of tail ·50. No filaments to the bristles of the mouth. Habitat, high central plains to the Pacific coast. *A. Nuttalli* Cass.

B. Wings very long and pointed, with a white bar across the outer primaries about midway between the carpal joint and the tip of the wings: the primaries not emarginated, the first and second equal and longest. Tail narrow and forked, with a small white bar, in the males, across all the feathers except the two central ones. Plumage rather compact. Bristles of the mouth scarcely appreciable. Partially diurnal in habits. CHORDEILES Swains.

1. Length 9·50; extent 21·50; wing 8·20; tail 4·60. Upper parts almost uniform greenish black with a mottling of yellow and ash. Under parts soiled white, transversely barred with brown. A pure white V-shaped mark on the throat commencing about a quarter of an inch behind the base of the lower mandible, the acute angle anterior, the branches curving back on each side to a point beneath and posterior to the eye. The angle of this mark is filled up with rusty tipped feathers. Wings nearly black, the upper coverts speckled with ashy. The five outer primaries with a pure white bar across them about half-way between the first joint and the end of the wing. Tail brown, with about eight transverse irregular bars of mottling, which are nearly white below, and light brownish gray above. The terminal blotch on all but the two middle feathers is white on both surfaces, larger and more quadrate, and scarcely reaches to the outer edge of the feathers. The female lacks the white throat marks, the white spots on the tail, and the wing patch is much less conspicuous. Habitat, eastern North America to Kansas. *C. popetue*, var. *popetue* Baird.
2. Similar to the preceding but much lighter. Habitat, whole of western country. *C. popetue*, var. *Henryi* Cass.
3. Length 8·40; extent 19·00; wing 7·00; tail 4·60. Above brownish black mixed with gray and rusty mottlings; the top of the head rather more uniformly brown. Nape furnished with a finely mottled collar of grayish and black. Scapulars and wing coverts finely variegated, the pattern somewhat irregular, and scarcely capable of definition A proportionally larger V-shaped white mark on the throat than in *C. popetue*. Rest of under parts dull white, transversely barred with brown, with a tinge of rufous on the abdomen and under tail coverts. Wings with round rufous spots, similar to those in the whippoorwills; the four outer primaries only with a white blotch across them, which is much nearer their tips than the carpal joint. Tail dark brown, with about eight lighter bars, the last white, extending across both vanes. The female lacks the the caudal patch. Habitat, southern portion of western North America. *C. Texensis* Lawr.

FARTHER OBSERVATIONS ON THE EMBRYOLOGY OF LIMULUS, WITH NOTES ON ITS AFFINITIES.*

BY A. S. PACKARD, JR., M.D.

IN a recent paper on the "Embryology of Limulus," published in the "Memoirs of the Boston Society of Natural History," I stated that the blastodermic skin, just before being moulted, consisted of nucleated cells, and also traced its homology with the so-called amnion of insects. I have this summer, by making transverse sections of the egg, been able to study in a still more satisfactory manner these blastodermic cells and to observe their nuclei before they become effaced during and after the blastodermic moult.

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* Read at the Portland Meeting of the Amer. Assoc. Adv. Sci.

On June 17th (the egg having been laid May 27th) the peripheral blastodermic cells began to harden, and the outer layer, that destined to form the "amnion," to peel off from the primitive band beneath. The moult is accomplished by the flattened cells of the blastodermic skin hardening and peeling off from those beneath.

During this process the cells in this outer layer lose their nuclei, and, as it were, dry up, contracting and hardening during the process. This blastodermic moult is comparable with that of Apus, as I have already observed, the cells of the blastodermic skin in that animal being nucleated.

This blastodermic skin in its mode of development may also safely be compared with the "amnion" of the scorpion as described and figured by Metznikoff, and we now feel justified in unhesitatingly homologizing it with the "amnion" of insects, in which at first the blastodermic cells are nucleated, and appear like those of Limulus. Moreover the layer of germinal matter, from which the blastodermic skin moults off, may be compared with the primitive band of insects. On June 19th, in other eggs, the cells of the blastodermic skin were observed to be empty, and the nuclei had lost their fine granules, and were beginning to disappear. The walls of the cells had become ragged through contraction, and in vertical section short peripheral vertical radiating lines could be perceived.

At this time an interesting phenomenon was observed. In certain portions of the blastodermic skin, or amnion, the cells had become effaced, and transitions from the rudiments of cells to those fully formed could be seen. From this we should suppose that the retention of these cells in the amnion of Limulus is due to the singular function this skin is destined to perform, *i.e.*, to act as a vicarious chorion, the chorion itself splitting apart and falling off in consequence of the increase in size of the embryo. In insects these cells disappear, and after the skin is moulted it appears structureless.

From studies afterwards carried on in the laboratory of the

Anderson School of Natural History, on the anatomy of the adult Limulus, I have been able to fully confirm the important discovery of Prof. Owen (Lectures,) 1852 and more recently of M. Alphonse Milne-Edwards* relative to the sheathing of the nervous cord and its branches by a system of arteries, and I would here bear testimony to the accuracy of Edwards' drawings and descriptions. Moreover I have been able by a study of living Limuli, beautifully injected by Mr. Bicknell by the kind permission of Prof. Agassiz, the director of the Anderson School, to extend still farther the anatomical researches of Milne-Edwards. With Mr. Bicknell's aid I have ascertained the existence of still smaller arterial twigs, on the peripheral subcutaneous portion of the body, than indicated by Milne-Edwards, and have made out the existence of an extensive series of closed vessels in the respiratory abdominal feet. For this I was prepared by a study of the respiratory lamellæ, which, in the arrangement of their chitinous septa, may be closely homologized with the gills of Amphipod Crustacea, as observed in living specimens without injection.

With the new information afforded us by A. Milne-Edwards, regarding the relations of the nervous cord with the ventral system of arteries, and the remarkably perfect circulatory system, so much more highly developed than that of any other Arthropod, I should no longer feel warranted in associating Limulus and the Merostomata generally with the Branchiopoda, but regard them, with the Trilobites, as forming perhaps a distinct subclass of Crustacea.

Certainly if we consider the relations of the anatomical systems to the walls of the body, the disposition of the segments forming those body walls, and the nature of the appendages, Limulus is built on the crustacean type. Because its nervous cord resembles that of the scorpion, and its circulatory system is more perfect than that of any Arthropod we know, this is no reason for assuming that it is not a Crustacean. On the same ground Ceratodus is not a fish because it has the lungs of a reptile, nor is Ornithorhynchus a Saurian because it has the shoulder girdle of a Saurian.† I have, moreover, shown that some important features in the embryology of Limulus are like those of the scorpion and the hexapodous insects, the "amnion" of Limulus apparently being homologous with that of the insects.

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*Recherches sur l'Anatomie des Limules. Annales des Sc. Nat., 1873.

†I have been reminded by Professor Wyman of this peculiarity in Ornithorhynchus as stated by Meckel.

In fact Limulus seems to me to be a synthetic or comprehensive type, bearing the same relations to the Crustacea that Ceratodus does among the fishes, or Archæopteryx among the birds; and because Limulus has strong analogies to the Arachnida, we should not overlook its true affinities with the Branchiopodous Crustacea.

Limulus may, then, be regarded as a Crustacean with the carapace of Apus, bearing simple and compound eyes as in that Phyllopod, with the antennæ foot-like as in many Entomostraca, and the abdominal appendages truly crustaceous in their structure, while the circulatory system is not fundamentally unlike that of other Crustacea, but only more perfect, and the digestive system is throughout comparable with that of the normal Crustacea.

ON A REMARKABLE WASP'S NEST FOUND IN A STUMP, IN MARYLAND.*

BY P. R. UHLER.

THE insects of the genus Polistes have not hitherto been reported to make nests of clay. All the North American species have been considered paper-nest-builders. Many species are known from the United States, Canada and the West Indies, and these are generally of a brown or yellow color, having spots or bands either lighter or darker.

In the present instance we have a dark brown species with narrow yellow bands across the abdomen, and with yellow feet, which builds a nest of clay in the form of a cylinder. In the stump of a decayed Liriodendron, found by O. N. Bryan, Esq., in Charles county, Maryland, a number of these insects had aggregated their cylinders. The stump was about two feet in diameter and the central cavity (which had been formed by the borings of large beetles) was five inches wide. In this, attached to the sides, sometimes lying flat in the grooves left by the beetles, or standing off at a considerable angle, and attached by their bases, were thirty-three of these peculiar structures. They were of a yellow clay, generally about half an inch in diameter, and varying in length

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* Read at the Portland Meeting of the Amer. Assoc. Adv. Sci.